

A REVISION OF THE NORTH AMERICAN SPECIES OF THE
BRACONID GENUS HABROBRACON JOHNSON (ASHMEAD).BY R. A. CUSHMAN, *Bureau of Entomology.*

The name *Habrobracon* was given by Ashmead in his Classification of the Ichneumon Flies (1900) to include those members of the genus *Bracon* in which the second abscissa of the radius is "not, or scarcely, longer than the first, usually a little shorter than the first transverse cubitus, or no longer." Previous to this date, however, W. G. Johnson published a note (*Ent. News*, 1895, VI, p. 324-5) in which he used the name in connection with the species *hebetor* Say and *gelechia* Ashmead. Ashmead (*loc. cit.*, p. 173) gives as the first publication of the name the above note by Johnson. This makes it necessary to credit the genus to Johnson. Viereck (*Bull. 83, U. S. Nat. Mus.*, 1914, p. 65) credits the genus to Ashmead and fixes *Bracon gelechia* Ashmead as the type.

The following description of the genus is gleaned from Ashmead's table of the tribe Braconini:

Second abscissa of radius not, or scarcely, longer than the first, usually shorter than the first transverse cubitus, or no longer. First discoidal cell petiolate; head, thorax, and abdomen most frequently coriaceous or shagreened, rarely smooth and shining; antennal characters as in *Bracon (sensu stricti)*; ovipositor short, rarely two-thirds the length of the abdomen, most frequently much shorter; last joint of hind tarsi about the length of the third, shorter than the second.

To the above may be added the following: Eyes more or less completely surrounded by a yellow or testaceous ring which sometimes extends inward so as to embrace more or less of the face and of the vertex; mandibles pale with black tips; first tergite with two furrows which converge anteriorly and set off a nearly equilateral, triangular, median area; second tergite subequal in length with the first, longer than the third, sculptured usually more coarsely than, and frequently differently from, those following.

The species of this genus show marked variations, not only in intensity and arrangement of color, but in such structural characters as the number of antennal joints, wing venation, sculpture and proportionate lengths of the tergites, relative length of ovipositor and abdomen, and even in the shape of the first tergite. A misunderstanding of the range of these variations, through lack of sufficient material for study, has led to the description of a number of species separated from others by the use of one or more of these variable characters.

The following table will separate the seven North American species referred to the genus. In the examination of the speci-

mens a Zeiss binocular with objective a₃ and eyepiece 4, giving a magnification of 61 diameters, was used. This high magnification is necessary for the observation of the minute sculptural characters used.

HABROBRACON JOHNSON (Ashmead).

TABLE OF SPECIES.

- Antennæ stout and tapering toward the tip, flagellar joints beyond the second but little longer than wide; ocellar spot nearly or quite separated from the occipital spot by inward extensions of the yellow orbital ring behind the ocelli; face largely or wholly yellowish..... 1
- Antennæ slender not tapering toward the tip, flagellar joints much longer than wide; ocellar spot and occipital spot broadly confluent... 2
1. Body smooth or but very faintly sculptured throughout; antennæ in female 13 to 15-jointed (17-jointed, according to Wesmael), in male 20 to 22-jointed (20 to 26, according to Wesmael); ocellar spot almost invariably entirely separated from occipital spot.
brevicornis (Wesm.) (= *hebetor* auct. not Say = *juglandis* Ashm.)
Body distinctly sculptured; antennæ in female 20 to 22-jointed, in male 23 to 25-jointed; ocellar spot except in very pale specimens not entirely separated from occipital spot..... *variabilis* n. sp.
2. Second tergite with a median embossed area set off at least anteriorly by crenulate grooves, its surface differently sculptured from the rest of the tergite (in the male this character is less evident, the area being more narrow and the grooves less distinct); rest of tergite more or less finely, irregularly, longitudinally or reticulately rugulose..... 3
- Second tergite without an embossed area, granularly roughened, without rugæ though sometimes with very fine reticulation on the basal middle..... 5
3. Furrows of first tergite narrow and not crenulate, the triangle without large punctures apically, lateral areas shagreened; second tergite reticulate..... *platynota* n. sp.
Furrows of first tergite broad and crenulate, the triangle with a few large punctures apically, lateral areas much roughened; second tergite longitudinally rugulose..... 4
4. Mesoscutum with a large quadrate testaceous spot in front of the scutellum from which lines of the same color extend forward along the positions of the notauli; face in female with broad inward extensions of the yellow orbital rings below the antennæ; antennæ testaceous, infuscated beyond the middle, 23 to 24-jointed, in male (lost, but from the description evidently a poorly developed specimen) 21-jointed; abdomen in female yellowish, darker laterally
xanthonotus (Ashm.)

Mesosecutum entirely black or with the color pattern reduced to lines indicating positions of notauli; face in female with the yellow reduced to a small spot beneath each antennal fossa, separated from the orbital ring by a brownish stain; antennæ black or occasionally somewhat testaceous, with 24 or more joints in female and 25 or more in male; abdomen in female with same color pattern as in *xanthonotus* but darker throughout, in male with the second tergite pale and the remaining tergites dark. *hopkinsi* Vier. (= *mali* Vier.)

5. Abdomen in female much wider than half its length, wider than the thorax, sixth and seventh tergites barely visible from above; female black, male with abdomen, especially second and third tergites, broadly margined with yellow, dark medially

gelcchia Ashm. (= *notaticeps* Ashm.)

Abdomen in female not much wider than half its length, not wider than the thorax; tergites 6 and 7 distinctly visible from above; sexes similarly colored. *johannseni* Vier. (= *tetralopha* Vier.)

Habrobracon brevicornis (Wesmael).

Bracon brevicornis Wesmael, Nouv. Mem. AS.SC. Bruxelles, XI, 1838, p. 23, fig. 2 (wing).

Brisehke, Sehr. Naturf. Ges. Danzig, (2) IV, 1882, p. 135. Host.—*Dioryctria abietella*.

Kirby, Trans. Ent. Soc. Lond., 1884, Proc., p. xxxi. Host.—*Ephestia elutella*.

Marshall, Trans. Ent. Soc. Lond., 1885, p. 24, Pl. I, figs. 1a (wing) and 1b (head and thorax). Redescription. Hosts.—*Myclois ccratoniae*. Galls of *Andricus terminalis*.

Geikie, Trans. County of Middlesex Nat. Hist. and Sci. Soc., Nov. 8, 1887. Host.—*Ephestia kuchniella*.

Ichneumonid Klein, Trans. Ent. Soc. Lond., 1887, Proc. p. lii-liv. Host.—*Ephestia kuchniella*.

Bracon brevicornis Billups, Trans. Ent., Soc. Lond., 1888, Proc. p. xxviii. Host.—*Ephestia kuchniella*.

Marshall, Andre's Spec. Hym. Eur., IV, 1888, p. 139. Redescription.

Bracon juglandis Ashmead, Proc. U. S. Nat. Mus., 1890, p. 62. Host.—Tined? infesting old walnuts.

Bracon brevicornis Danysz, Bull. Séances Soc. Ent. France, 1893, p. clxxviii.

Habrobracon hebetor Johnson, Ent. News, VI, 1895, p. 324. Host.—*Ephestia kuchniella*. Also mentions Klein's article using name *Bracon brevicornis*.

Bracon (*Habrobracon*) *honestor* Riley and Howard, Ins. Life, VII, 1895, p. 428. Misprint in specific name corrected in general index. Host.—*Plodia interpunctella*.

Bracon brevicornis Schmiedeknecht, Illust. Wochenschr. f. Ent., I, 1896, p. 541.

Bracon (Habrobracon) hebetor Chittenden, U. S. Dept. Agr. Bur. Ent. Bul. No. 8 (n.s.), 1897, pp. 38-40. Suggests possibility, according to Ashmead of synonymy with *brevicornis*. Hosts.—*Ephestia cahiritella*, *Galleria mellonella*.

Bracon juglandis Chittenden, loc. cit. Referred to as variety of *hebetor*. Hosts.—*Ephestia cahiritella*, *Plodia interpunctella*.

Habrobracon hebetor Buchwald & Berliner, Zeitschr. f. d. gesamte Getriedewesen, II, 1910, pp. 1-4, figs. 1 and 2. Host.—*Ephestia kuehniella*.

Specimens in the National Museum determined by Ashmead and others as *hebetor* Say and *juglandis* Ashm. agree with Marshall's description of *brevicornis* Wesm. and are identical with a specimen from Europe determined by Schmiedeknecht as *brevicornis*. Chittenden (Bur. Ent. Bul. 8, p. 39) suggests, on the authority of Ashmead, that these two species are synonyms of *brevicornis* Wesm. All of the reared specimens of *hebetor* and *juglandis* in the collection are reared from hosts that breed in stored products of various sorts, principally from various species of the genus *Ephestia*. This seems to be the normal host of the species as well as of *brevicornis* in Europe. All the specimens in the National Museum that can be construed as agreeing otherwise with *hebetor* Say differ from the original description of that species in having the coxæ largely black not "yellowish-white." Furthermore, Say makes no mention of the black occipital spot which appears in all dark specimens. In the description of *Bracon dorsator* on the page following that of *hebetor*, Say observes that *dorsator* agrees with *hebetor* in that "the first cubital cellule is wider by one-third than the second at their junction." In all the specimens in the National Museum this difference is at least one-half and usually more. It seems from these facts that the specimens reared from such hosts as those mentioned above are not the *hebetor* of Say. Such being the case the *hebetor* of authors must sink into synonymy with *brevicornis* Wesm., while the *hebetor* of Say must stand as an unknown species.

Specimens of this species in the National Museum, in addition to those which agree with Marshall's description of the species, show variations of practically all grades from those in which the dorsum of the thorax and abdomen is entirely black except the apical tergite and faint traces of the thoracic markings, and the ocellar and occipital spots narrowly joined, to those in which the color is largely yellowish without the typical spots on the head, the dark color of the mesonotum reduced to three small spots and the abdomen nearly uniformly pale. In some specimens the head is practically all black with only faint indications of the color pattern. The number of antennal joints in females

varies from 13 to 15 and in males from 20 to 22. The size also varies considerably, the smallest males being about 2 mm. long and the largest females about 3 mm.

The material examined consists of nearly a hundred specimens from Illinois, Massachusetts, California, Nevada, Florida, West Virginia, Ohio, New York, and the District of Columbia together with a number of unlabeled specimens and three from Europe. Many of these were reared from such hosts as *Ephestia kuehniella*, *E. elutella*, *Plodia interpunctella*, and *Galleria mellonella*.

Habrobracon variabilis n.sp.

Female: Length 3 mm. Face and orbit yellow, this color triangularly extended inward behind the ocelli from each side so that the dark spot in which are located the ocelli is nearly separated from the dark occipital spot; antennæ 21-jointed, black, stout, tapering toward the apex, the joints of the flagellum except the first but little longer than thick; palpi yellowish.

Thorax largely dark brown above, the scutellum laterally, posterior middle of mesoscutum and the positions of the notauli testaceous; testaceous below; all legs except hind coxæ basally, hind tibiæ apically, and basal joints of hind tarsi, which are infuscated, testaceous; wings dusky, apical third hyaline, veins except costa and anterior edge of stigma pale, a small whitish spot on the base of the stigma.

Abdomen with the first tergite dark brown, pale apically, the second testaceous except for a dark spot on the basal middle and a suffused spot on each side, the third, fourth, and fifth dark brown except laterally and medially where they are testaceous, the remaining visible tergites testaceous; first tergite with the furrows crenulate, the triangle without large punctures apically, sides beyond spiracles arcuate; second tergite with a median basal embossed area, coincident with the median dark spot set off laterally by obscurely crenulate furrows, rest of tergite finely, irregularly, longitudinally rugulose; third to fifth similarly sculptured but the sculpture changing gradually until in the fifth it becomes reticulate rugulose; remaining tergites barely visible; exerted portion of ovipositor slightly less than half the length of abdomen.

Male: Length 2.5 mm. similar to female; antennæ 25-jointed, more slender, all flagellar joints distinctly longer than thick; all coxæ testaceous; first tergite pale testaceous with the triangle somewhat darker and with its sides straight; second tergite entirely yellowish.

Host.—*Canarsia hammondi*.

Type locality.—Siloam Springs, Ark.

Type Cat. U. S. N. M. No. 18275.

Allied to *brevicornis* Wesm. from which it is at once distinguished by the distinct abdominal sculpture, the larger num-

ber of antennal joints, the entirely yellow face, and the partial coalescence of the ocellar and occipital spots.

Described from 3 females and 2 males (the type female, male, and paratypes *a*, *b*, and *c*) labeled Quaintance No. 5155, Siloam Springs, Ark., 9.26.08, S. W. Foster, collector, parasite of *Canarsia hammondi*; 2 females (paratype *d* and 1 other) labeled 440⁰¹, issued Aug. 20, '90, Par. on *Pempelia hammondi* from Miss Murtfeldt; 2 females (paratype *e* and 1 other) from Champaign, Ill.; 3 males (paratypes *f* and *g* and 1 other) labeled Quaintance No. 5083, Siloam Springs, Ark., 6.26.08, S. W. Foster, par. of *Enarmonia prunivora*; 5 females and 2 males (paratypes *h-l* and 2 others) labeled Parasite of *Desmia funeralis*, Vienna, Va., Sept. 15, Quaintance No. 10622, J. F. Strauss, collector; 4 females (including paratypes *m* and *n*) Midvale, Pa., Sept. 1, 1913, Quaintance No. 6126, F. L. Simanton, Coll., parasite of *Laetilia coccidivora*.

This species is extremely variable in color, although the color within a series from an individual host is quite constant, varying, as a rule, only in minor details. The paratypes show all grades of variation, *e* being much paler and *k* much darker than the type female. In *e* the ocellar and occipital spots are entirely separated; mesoscutum entirely yellowish-testaceous except a narrow median line anteriorly and a suffused spot on each hind angle; scutellum pale throughout; propodeum somewhat lighter, especially laterally, where it is testaceous; legs pale, hind coxæ yellowish; stigmal spot occupying nearly half of the stigma; first tergite testaceous except triangle basally, second tergite yellow throughout; on the remaining tergites the light markings are somewhat more extensive and paler. Paratype *i* is smaller and much darker than the type, the thoracic markings practically obsolete and the color pattern of the abdomen very obscure, face with a median dark line which broadens out into a spot on the clypeus. In paratype *n* the ocellar and occipital spots are broadly joined.

Habrobracon platynotæ n.sp.

Female: Length 3 mm. Head black with the face fuscous, the orbital ring, genæ, and a spot below each antenna yellowish; orbital ring broadly interrupted behind the eye with a small pale spot immediately behind the eye and not extending mesad behind the ocelli; mandibles colored like the face with black tips; antennæ black, long, 24-jointed, uniform in thickness, the basal flagellar joints about $1\frac{1}{2}$ times as long as thick.

Thorax black, legs testaceous except that the apical joint of the front tarsi, the middle and hind tibiæ and tarsi, and the coxæ basally are infuscated; wings dusky with the apical third hyaline, the veins fuscous.

Abdomen testaceous somewhat infuscated especially beyond the second

tergite; first tergite testaceous with the anterior angle of the triangle somewhat infuscated, the furrows not crenulate, the areas shagreened; second tergite with the median embossed area distinct only basally its sides diverging rapidly, this and the base of the third tergite reticulately roughened, the third apically and the fourth and fifth entirely granularly roughened; exerted portion of ovipositor half as long as abdomen.

Male: Differs from female principally in its smaller size and in having the four anterior coxæ and femora largely blackish, and the embossed area of the second tergite indistinct.

A single female paratype agrees in all respects with the type.

Host.—*Platynota* sp.

Type locality.—Hollywood, Calif.

Type Cat. U. S. N. M. No. 18276.

Described from the above three specimens which were reared May 12, 1913, by J. E. Graf of the Bureau of Entomology.

Habrobracon xanthonotus (Ashm.)

Bracon xanthonotus Ashmead, Proc. U. S. Nat. Mus., XI, 1888, p. 618.

The only specimens of this species in the National Museum are the 14 females of the type series and two others. The type male is apparently lost. From its small size and the fact that it had fewer antennal joints than the female it must have been a dwarf and poorly developed specimen.

The only characters that I have been able to discover that will separate this from the following species are variable, and I believe that the two are conspecific, but hesitate to reduce *hopkinsi* Vier. to synonymy because of the paucity of intergrades between the two types. One of the specimens agrees with *hopkinsi* in facial markings.

Habrobracon hopkinsi Vier.

Habrobracon hopkinsi Vier., Proc. U. S. Nat. Mus., vol. 38, 1910, p. 380.

Habrobracon mali Vier., Proc. U. S. Nat. Mus., vol. 44, 1913, p. 641.

The character in which Viereck considered his *mali* to be allied with *xanthonotus*, as indicated in his description of *mali*, and in which it differs from *hopkinsi*, is found in a manuscript table to the species, and consists in the possession of testaceous markings on the mesoscutum. His description of the species consists of a statement of the differences between it and *xanthonotus*. All of the characters used are those which an examination of a large number of specimens of several of the other species of the genus shows to be subject to extreme variation. This is especially true of the color patterns of the thorax and abdomen and the number of antennal joints.

H. hopkinsi was described from a series of 18 specimens reared from *Notolophus oslari*. It is described as having the mesonotum entirely black, and yet, in the type series, there is one female that shows the testaceous markings in the position of the notauli quite distinctly. A careful examination of every specimen of the type material in both *hopkinsi* and *mali* together with another series of *mali*, reared by the writer from the same host and locality, and a large series of specimens mostly reared from *Clisiocampa pluvialis* and *C. constricta* in California, some of which resemble *hopkinsi* and some *mali*, has convinced me that the two are but variants of the same species. Aside from the mesonotal markings there is comparatively little variation in color in the species as at present limited, but in the number of antennal joints there is considerable variation. In the *hopkinsi* series the females have 24 to 25 antennal joints and the single male with complete antennae has 25 joints; in the *Clisiocampa* series the females have 24 and the males 28 to 29 joints; and in the *mali* series the females 27 and the males 28 to 29 joints. Some of the specimens of the *Clisiocampa* series show a tendency toward *xanthonotus* in the color of the antennae. In addition to the material mentioned above there are in the National Museum specimens from New Hampshire, California, Malden (Mass.?), and a series of 5 specimens from Yosemite, Cal., reared from a Noctuid (?) larva. The last differ from the type in being somewhat larger and in having the markings somewhat paler and more extensive, and agree with the type of *mali* in the number of antennal joints.

The *Bracon* n. sp. of Ins. Life, II, p. 349, parasitic on *Clisiocampa constricta* belongs here and is a part of the material examined.

The *Bracon gelechia* of New Hampshire Exp. Sta. Bul. 6, Tech. Ser., is undoubtedly this species.

Habrobracon gelechia Ashm.

Bracon gelechia Ashmead, Proc. U. S. Nat. Mus., 1888, p. 623.

Bracon notaticeps Ashmead, loc. cit., p. 624.

Habrobracon gelechia Johnson, Ent. News, VI, 1895, p. 324.

The female of this species can at once be distinguished from *johannseni* Vier. by the greater width of the abdomen as compared to its length and to the width of the thorax and by the retraction of the terminal tergites. The male is at once distinguished by the color pattern of the abdomen, black bordered with yellow which extends nearly to the middle on the second tergite.

Comparison of the types of *notaticeps* (Ashm.) with those of *gelechia* proves the two species to be the same, the differentiating

characters as given by Ashmead in his description of the latter species, that is, the color of the legs and the number of antennal joints, being both very variable characters.

The only female of this species in the type series lacks entirely the yellow tergal color ascribed to the species by Ashmead in his description. Unfortunately also the head is missing. It is possible that the female and the males are of different species, the opposite sex of each of which has not been identified. The exact status in this respect can not be satisfactorily determined except by the rearing of more material under careful observation.

One female from Kansas collected by C. L. Marlatt and labeled by Ashmead *Bracon notaticeps*, which differs from the type in having the abdomen brown on the sides, has been provisionally referred to this species.

The *Bracon* n. sp. of Ins. Life, II, p. 349, parasitic on *Gelechia roseosuffusella* Clem. belongs here and is a part of the material examined.

Habrobracon johannseni Vier.

Bracon sp. Johannsen and Patch, Bul. 195, Maine Agr. Exp. Sta., 1912.

Habrobracon johannseni Viereck, Proc. U. S. Nat. Mus., vol. 42, 1913, p. 622.

Habrobracon tetralopha Viereck, loc. cit., p. 623.

Redescription of type female.—Length 2 mm. Head black with a narrow interrupted line above and in front of the eyes dark testaceous; mandibles testaceous, black at tips; antennæ black, slender, uniform in thickness, 22-jointed.

Thorax black throughout, delicately shagreened; legs blackish, testaceous at the articulations, hind tibiæ and tarsi largely testaceous; wings hyaline with the veins brownish and the pubescence blackish, paler toward base of wing.

Abdomen black above narrowly bordered with testaceous posteriorly, about half as wide as long and about as wide as thorax, the sixth and seventh tergites extended; first tergite with the furrows narrow and not crenulate, its surface shagreened, sides beyond the spiracles straight and parallel; second tergite granularly and slightly reticulately roughened; tergites 3, 4, and base of 5 shagreened, 5 apically and 6 and 7 smooth; exerted portion of ovipositor half as long as abdomen.

This species was originally described from two specimens reared from an undetermined Tineid in pine cones at Orono, Me. In the same paper Viereck described *H. tetralopha* from two females and a male reared at Lafayette, Ind., from *Tetralopha baptisiella*. The description of the latter species consists of a comparison with *johannseni*. The only characters used, length,

number of antennal joints, and color of hind femora, are all very subject to variation throughout the genus. The types of the two species differ also in the shape of the first tergite. In *johannseni* the sides of this segment beyond the spiracles are straight and parallel while in *tetralophae* they are curved and slightly divergent. Examination of a large series of specimens from other sources shows that the shape of this tergite varies from the form shown in *johannseni* to those showing even more curvature and divergence than in the type of *tetralophae*. In all of the males the first tergite is of the form exhibited by the type of *johannseni*.

Besides one of the type specimens of *johannseni* and three of *tetralophae* the following material was examined: a large series reared by J. E. Graf at Los Angeles and El Monte, Calif., from *Phthorimea operculella* under Chittenden No. 2229; 3 specimens from the same host at Norfolk, Va., Chittenden No. 2721^a; 12 females and 1 male from *Desmia funeralis* in Fairfax Co., Va., Quaintance No. 5569, J. F. Strauss; 2 females from the same host from the Ashmead collection; 1 female from Riley Co., Kans., Marlatt; 2 females from Champaign, Ill., 2 females from Oswego, N. Y.; 2 females from Salineville, Ohio; 1 female from Franklin Co., Ark., Webster; and 1 female from Agr. Coll., Mich. All the California parasites of *Phthorimea* resemble the type of *johannseni* in color except that the light margin of the abdomen is somewhat more distinct. In this series nearly all gradations in the shape of the first tergite are found. The Virginia parasites of *Desmia* agree in color of the legs with *tetralophae* and show some variation in the shape of the first tergite, but are mostly somewhat larger than the types. The New York specimens agree with *tetralophae* except that the orbital ring is somewhat paler and more distinctly defined. In the Kansas specimen the black color of the abdomen is replaced by brown, and the border is yellow, while all of the legs are pale. In the two specimens reared from *Desmia* without locality and the two Illinois specimens the reduction of the abdominal color is carried still further, while the mesopleuræ and pronotum laterally are more or less testaceous to yellowish. The number of antennal joints in the female varies from 19 to 36, the smaller specimens having the smaller numbers. In the males of the *Phthorimæa* series the antennæ are from 23 to 27 jointed; neither of the other males has the antennæ entire.
